

## RESTAURANT AUTOMATION SYSTEM

### FIELD OF THE INVENTION

The present invention relates to automated restaurant  
5 management systems, and to the automation of order taking,  
bill paying and other services.

### BACKGROUND OF THE INVENTION

Many restaurants run on thin profit margins.  
10 Instituting operational efficiencies in a restaurant can  
have an enormous impact on the bottom line. Hence,  
instituting efficiencies are always needed to increase the  
revenue per seating, and/or to increase the number of  
sittings per day. In addition, certain efficiencies and/or  
15 customer services produce the ability to attract and retain  
more patrons. There has been no shortage of proposals to  
make the backend (kitchen, waiter, inventory control,  
supply ordering, etc.) operations of restaurants more  
efficient. More recently, the use of small, powerful  
20 computing devices, has been proposed to create efficiencies  
in the front-end operations (customer interfacing).  
However, to be adapted for restaurants, more efficient  
operational solutions must be inexpensive, and have a short  
return on investment (ROI). In the restaurant business, a

large capital investment generally presents a barrier to the adoption of otherwise beneficial solutions. In addition, the cost of a proposed improvement must be offset by the operational efficiencies it provides. Further, for 5 restaurant customers, both ease-of-use and elegance are significant success factors. Any new restaurant system must not present a learning burden to the diner, but should be intuitive, allowing the diner to succeed in using it the first time.

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It has been proposed to improve the efficiencies in restaurant operations by permitting waiters to electronically transmit orders to the kitchen. Indeed, some systems permit the customer or diner to directly send 15 orders to the kitchen.

For example, U.S. Patent No. 6,425,524 to Pentel describes a remote ordering system using hand-held devices such as at 112, in Fig. 12a, which transmit orders to an 20 order station. The hand-held device utilizes key pad entry for placing an order, which may be displayed on an LCD screen before sending the order to the order station. The menu is presented on a separate apparatus called a display

device which displays the ordering numbers associated with different food orders. It may also have a screen displaying the order message received. In its broadest application, the restaurateur may also post a pre-viewing 5 menu on a website, and the components of the had-held device imbedded in a cell phone. Though the patent describes an "order ready" signally means, and a "change/recall" order means, there is no message for when the food preparation has started. A customer order number 10 may be sent to the hand-held device, but there is no means described for assigning a table ID. Pentel also discloses an ordering system for a drive-thru restaurant (Figs 1, 1a, and 2) wherein the transmission from the hand-held device 12 may be a short range line-of-sight remote control device 15 transmitting to a drive-up display menu. The hand-held devices have key pads which are impractical in a restaurant/dining environment full of drips and crumbs which can jam the keys. No graphic representation of the food items available is presented on the screen. Nor are 20 there pop-up display of food offerings to explore further and further the details of the menu.

U.S. Patent 5,838,798 to Smith discloses a hand-held portable device for placing an order to a server, and then to a kitchen terminal. However, these devices are intended to be operated by the waiter, hence, the level of detail, 5 comprising graphic representations of the food offering need be minimal, as the waiter knows the menu.

TouchPak sells a system, called an entertainment portal. Customers waiting to be seated may be presented 10 with the device, from which they can pre-view a menu, preorder, surf the Internet and receive a table ready signal.

In a restaurant where customers are seated before 15 ordering, an interactive system has been proposed, according to which an interactive table display must be used by each diner at the table. These systems vary from the traditional arrangement wherein each diner is permitted his/her own menu, to consult individually. Some of the 20 systems proposed for increased efficiency require a change in operational steps, or interactive sequences of conventional dining, and thereby present an adaptability barrier to widespread customer acceptance. What is needed

is a solution that is familiar in its presentation and yet, substantially rich in underlying functionality.

Despite the plethora of new restaurant management system solutions, the customer's experience in a restaurant has hardly changed through the years. In a traditional restaurant, a large percentage of time is actually spent waiting for the waiter, rather than eating. First, one must wait for the waiter to take an order. The length of this waiting period bears no relationship to the hunger or desires of the customer. Next, one must interrupt eating while waiting for the opportunity to catch the waiter's attention if a water or soda refill, or other adjunct item, such as a relish or dressing, is necessary. Finally, among other services, one must wait for the waiter to provide a check and then, wait again, for him to return with the receipt. Not only does this impose suffrage on the customer in terms of waiting, but it may also preclude synchronization of the various courses of the meal. Since up to half the time spent in the restaurant may be spent waiting for the waiter, the restaurant also loses revenue, as the table cannot be turned for the next customer.

During an evening, up to an entire table service may be lost.

The present invention not only provides increased 5 efficiencies in the operation of the restaurant, but provides vast enhancements in the menu, ease of payment, information and/or entertainment provided to the customer, with no loss in comfort or elegance. In a preferred embodiment, the present invention provides a 10 personalization/benefits system customized to the dining patterns of each diner. The present invention hence presents a win-win solution for the restaurateur and the diner. Perhaps most significantly, the present invention eliminates or substantially reduces the need for 15 waiters/cashiers/hostesses thereby introducing a novel operational model for the restaurant industry that can result in favorable cash flow economics.

#### SUMMARY OF THE INVENTION

20 In its preferred embodiment, the present invention provides a restaurant automation system which comprises at least an Automated Ordering System (AOS) component system, and may also include at least one of following component

systems; the Waiter Call System (WCS), the Reception Management System (RMS), and the Customer Personalization System (CPS).

5 The Automated Ordering System

The Automated Ordering System (AOS) is the core component of the Restaurant Automation System and consists of the AOS function on the RAS compute server, the E-Menu, and, optionally, the Payment Station, as its main 10 components. The E-Menu represents a significant evolution in restaurant service technology and distinguishes the AOS and RAS of the present invention from other suggested automation systems. The E-Menu is a low-cost interactive device that provides users with a platform for the display 15 of rich content information provided by a restaurant compute server. Whereas many applications for the E-Menu are envisioned, in the current embodiment, the E-Menu is used directly by individual restaurant diners (as opposed to waiters or cashiers). The diners may use the E-menu to 20 access text, graphical, video, audio information relating to the restaurant's menu, as well as other relevant information regarding the chef, restaurant background, live kitchen video, etc. Far more information can be displayed

on an E-menu than a paper menu or blackboard. It also provides an interface through which the diners may directly place food orders with the kitchen, receive status on order preparation, direct the generation and payment of bills, 5 access the Internet, etc.

The E-Menu represents an evolution of the traditional hardcopy menu and provides a number of usability and economic benefits. At the same time, the E-Menu is 10 designed to be gracefully and to be easily adopted by the general public because of its similarity in basic operational sequence to the traditional menu and human interface design.

15 The AOS provides several benefits to both the customer and the restaurant industry. First, it removes customer dependency upon the waiter. The E-Menu, when used as part of the overall Automated Ordering System, grants full control of the dining experience from information access, 20 bill payment, meal course timing, entertainment, etc. directly to the customer. The E-menu also provides customers with richer information content than a waiter can provide, and also allows dining times to be more controlled

and predictable. This allows customers to dine out in situations where they otherwise would not have because of perceived time constraints. This leads to a simultaneous benefit for the restaurant industry.

5       Second, since the AOS and E-Menu provide rich content information on the meals (photos, ingredients, preparation, nutrition, specials, etc.) in a dynamic format, it makes it easy for customers to be more educated about what they are ordering. For example, photos provide a clear depiction of  
10 what the meal will look like prior to ordering. This eliminates unexpected surprises regarding portion size, appearance, etc., thereby increasing satisfaction with the dining experience. This thereby provides obvious benefits to the restaurant industry.

15       Third, the E-Menu and the Restaurant Automation System in general, significantly reduce the amount of time diners waste in a restaurant waiting for services and items because of waiter/cashier dependency. This allows the restaurant to turn the table more quickly resulting in a  
20 greater number of table services, which in turn, results in greater revenue.

Fourth, the E-Menu serves as a dynamic advertising medium through which the restaurant industry may derive an additional revenue stream.

Fifth, the AOS increases the restaurant's ability to 5 quickly adapt to changing tastes, styles, specials, etc. by providing a menu platform that can be updated dynamically. Specifically, once menu changes have been made in the RAS compute server, all the E-menus have immediate access to the updated information. In addition, the entire style, 10 motif or design of the restaurant may be adjusted rapidly by changes made at the server.

The E-Menu, may be approximately the size of a traditional menu. It can present the menu contents in a familiar way on a large touch sensitive LCD display with 15 the additional functionality of presenting rich content information related to the restaurant, chef, meals, etc. The E-Menu may also provide a web browser or similar platform by means by which diners can access a restaurant's web server for web pages that define the restaurant's menu, 20 specials, etc. The restaurant's web server (running on the RAS compute server) accesses a (preferably) broadband Internet connection and provides a proxy server function

such that, when permitted, diners may access the Internet from their E-Menu.

In an alternative embodiment, the E-Menu may be a  
5 light weight display appliance in terms of processing requirements, power requirements, software, cost, etc. that simply displays pre-processed graphical data from the restaurant's RAS compute server.

The E-Menu has a standard wireless network interface  
10 and communicates over a standard wireless Local Area Network (LAN) to a Restaurant Automation System compute server (compute device). The RAS compute server hosts the central intelligence and functions of the overall RAS system within a RAS equipped restaurant. The AOS function  
15 is one such function.

The Automated Ordering System also automates the process of bill payment and reduces dependence on the waiter. The service staff will still be needed for cash payment). At any time during the dining process, a  
20 customer can request to have his table order tallied and sent to a Payment Station at which he may make payment. Various billing schemes per table can also be facilitated.

### The Waiter Call System

The Waiter Call System (WCS) provides customers with an efficient means to attract the attention of the common service staff, and to provide an indication of what they 5 desire. In a preferred embodiment, the system utilizes various colored lights in an appropriately decorative tabletop display, called a Table Call Unit, to convey the message. If desired, such as when a line-of-sight viewing of the Table Call Unit is not feasible, a more centrally 10 located Call Status Display, detailing the messages from a number of tables, can be used. Any member of the common service personnel pool can attend to the request. The specific color or light pattern of the request can identify what is requested. After the request has been satisfied, 15 the WCS Function of the RAS server stores information related to the request and its service in the common data store for Quality of Service (QOS) gauging and reporting.

Diners using the Waiter Call System do not have to waste time catching the attention of a particular waiter. 20 Instead, the WCS sends a clear signal that is visible to any member of the common service pool. Using the color of the signal to convey a basic message as to what is desired avoids the traditional waiter double-trip (waiter first

comes to ask what you want and then goes off again to get it). This saves time in two ways. First, as any member of the service staff that is available can satisfy the request, the time benefits of a multiple server queuing 5 model are realized. Second, there is no longer a need to visually catch the attention of a specific waiter, as any member of the common service pool can readily see the visible light.

10 The WCS and the RAS in general, prescribe a different approach to the traditional restaurant service operational model. Whereas the traditional restaurant assigns waiters to specific tables and areas, the Restaurant Automation System introduces the concept of a common pool of service 15 personnel that service the entire restaurant. The model of the WCS is akin to the efficient single queue-multiple server system for service in such facilities as banks.

#### The Reception Management System

20 The Automated Ordering System function in the RAS compute server maintains information regarding the dining status at each table, such as what has been ordered (appetizer, main course, coffee, etc), the time elapsed,

bill requested, etc. This information is fed to the Reception Management System (RMS) which determines the expected wait time for each table. This wait time may be displayed on a Reception Display in the reception area.

- 5 Arriving customers can enter their names in lists, or queues, for tables of a specific size, based on this expected wait time information.

The Reception Management System eliminates the need for human receptionists to guess, and, perhaps, to

- 10 inaccurately estimate wait times for tables of various capacities.

The RMS may also allow the service staff to accept call-in reservations and enter these reservations into the RMS's scheduling function via the Reservation Display. The

- 15 RMS coordinates the scheduling of tables based on call-in reservations, walk-in customers who enter into queues, and expected table wait time information based on real-time dining status.

The RMS may be set to calculate table wait times based

- 20 on real time dining status information for the particular restaurant, and allocates tables based on input from the Reception Display and the Reservation Display.

The RMS may be used in conjunction with current systems used to call waiting customers, such as blinking drink coasters, and may also offer an optional restaurant mapping application that facilitates customer self-seating.

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The Customer Personalization System

The customer and restaurant intelligence of the Restaurant Automation System within a restaurant resides in the main RAS compute server. This server maintains the 10 restaurant menu, chef information, restaurant history, hyperlinks to advertiser's website, table status, and other rich content and makes it available to the E-Menu devices, Reception Display, Kitchen Order Display, and other displays of the restaurant's RAS. The RAS compute server 15 also maintains information on Internet web sites visited by diners (but may not have the capability of identifying who visited what site), food-ordering patterns, dining times per table, throughout the day, etc. All this information can be used by the restaurant managers and by restaurant 20 marketing organizations to develop systems and food products better suited for the restaurant industry.

The Service Management Function, one of the RAS common functions (described later) running on the RAS compute server, provides a means of regularly compiling information and sending it to the RAS Central Service Center where it 5 may be reviewed by the Central Service Center personnel. Information from the data store of each restaurant's RAS Compute Server is automatically transmitted to the RAS Central Server located at the RAS Central Service Center via the Internet link or via a dial-up means. This allows 10 the RAS Central Service Center personnel to identify trends and track performance and error statistics on each restaurant's RAS implementation. The intention of this "call-home" system is to allow the RAS Central Service personnel to proactively monitor the effectiveness of the 15 Restaurant Automation System at each establishment and to proactively take action to upgrade or replace systems/components before failure. This alleviates the restaurateur from the burden of managing the RAS system thereby reducing costs and allowing him to focus on his 20 primary business of food preparation and service.

Another advantage to the collection of restaurant and customer intelligence on the RAS system is that it allows

personalization of services for specific diners based on patronage frequency and dining patterns. For example, if a specific diner frequents RAS equipped restaurants or shows a preference for kosher meals based on the information in

5 the data store of the RAS Central Service Center server, the RAS system may apply discounts to his bill or may provide focused meal advertising, specials, or suggestions via the E-Menu platform. This collection of data essentially allows for the creation of an automated and

10 customized "frequent diner" program for the restaurant industry.

There are a number of RAS system functions common to the component systems. For instance, a common data store

15 provides a data repository that is shared by all four component systems. A common Service Management function monitors effectiveness and performance of the restaurant's RAS system and communicates this information to the RAS Central Service Center. A Web Server function provides

20 access to the RAS customer functions and the data store for all E-Menus and interactive displays in the RAS system. A common Configuration function allows restaurant management to easily configure various aspects of the RAS

implementation to formulate menu content and track performance.

It is the intention of the current invention to not  
5 only provide significant increases in operational efficiency, but by its nature, to provide a near-zero ROI or time to recover the investment made in the solution. It is also the intention of this invention to overcome the economic and adoptability barriers faced by current  
10 solutions.

These objects, as well as other objects which will become apparent from the discussion that follows, are achieved, in accordance with the present invention, which comprises a RAS comprising an AOS including an electronic  
15 menu, and, optionally, a WCS, a RMS and/or a CPS.

Another embodiment of the invention comprises the Waiter Call System, which may be implemented as a stand alone Table Call Unit, with or without a decorative component. This embodiment may also include a timer  
20 display and/or a call status display. If desired, a server may be added to the Water call system, with the Table Call Unit in wireless communication with the server, which is

tracking restaurant management data related to the Waiter call System. This embodiment of the invention requires little beginning investment, but provides considerable value for the diner and the restaurant owner.

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For a full understanding of the present invention, reference should now be made to the following detailed description of the preferred embodiments of the invention as illustrated in the accompanying drawings.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates the overall Restaurant Automation System Product Structure, comprising four component functions of a preferred embodiment of the present invention.

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Figure 2 is a schematic of the overall Restaurant Automation System Architecture of a preferred embodiment of the present invention.

Figure 3 is a schematic of an alternative overall Restaurant Automation System architecture of a preferred embodiment of the present invention, having a different software framework/E-Menu architecture. Note that the

wireless networking technology shown uses 802.11x and TCP/IP standards. This is one implementation option.

Figure 4 illustrates a second alternative overall architecture of the Restaurant Automation System of a 5 preferred embodiment of the present invention, having another software framework/E-Menu architecture. Note that the wireless networking technology shown uses 802.11x and TCP/IP standards. This is one implementation option.

Figure 5 illustrates the home screen of the Menu 10 Modify function of a preferred embodiment of the present invention accessed through the Kitchen Order Display.

Figure 6 illustrates the Menu Modify function screen for a specific item in the menu according to a preferred embodiment of the present invention.

15 Figure 7 illustrates the Waiter Call System architecture of a preferred embodiment of the present invention.

Figure 8 illustrates the Waiter Call System's Table 20 Call Unit used by diners to call the attention of the service staff.

Figure 9 illustrates the Call Status Display system according to preferred embodiment of the present invention.

Figure 10 illustrates the Service Call Process Flow associated with the Waiter Call System of a preferred 5 embodiment of the present invention.

Figure 11 illustrates the overall architecture of an Automated Ordering System according to a preferred embodiment of the present invention.

Figure 12 illustrates a preferred embodiment of the E-10 Menu.

Figure 13 illustrates a preferred Kitchen Order Display Screen of a preferred embodiment of the present invention.

Figure 14 illustrates one embodiment of a Payment 15 Station, which consists of a processor with a wireless network interface and a touch screen monitor

Figure 15 illustrates the simplified Bill Payment Process Flow for customers making cash payment.

Figure 16 illustrates the Table Payment Display screen (on the Payment Station Monitor) showing the payment status of all tables.

Figure 17 illustrates the simplified Bill Payment

5 Process Flow for customers making credit card payment.

Figure 18 illustrates the simplified Individual Bill Payment Process Flow for individual table diners making credit card payments.

Figure 19 illustrates the simplified Ordering and  
10 Process flow, with confirmation, for one alternative method of a party of three ordering a meal.

Figure 20 illustrates the simplified Ordering and Process Flow, with confirmation, for a second alternative method of a party of three ordering a meal.

15 Figure 21 illustrates the Reception Management System architecture.

Figure 22 illustrates the Reception Management System Table Wait Time Summary screen according to a preferred embodiment of the present invention.

Figure 23 illustrates the Reception Management System  
Join Queue screen giving customers information on wait  
time, and the ability to enter a queue to wait for a table  
according to a preferred embodiment of the present  
5 invention.

Figure 24 illustrates the Reception Process Flow of  
the Reservation Management System for a customer entering a  
full restaurant who decides to wait for a table.

Figure 25 illustrates the Customer Personalization  
10 System architecture.

Figure 26 illustrates the Personalization Function  
Process Flow for a customer participating in the Customer  
Personalization System.

Figure 27 illustrates a sample home screen on an E-  
15 menu.

Figure 28 illustrates the main menu screen from which  
diners can navigate into sub menus, according to a  
preferred embodiment of the present invention.

Figure 29 illustrates a sample home screen of a  
20 preferred embodiment of the E-Menu for Internet surfing.

Figure 30 illustrates a detailed description screen of a preferred E-menu that provides more information on a particular menu choice.

Figure 31 illustrates a sub menu for a particular meal 5 course e.g., wine list.

Figure 32 illustrates the Internet access screen of a preferred embodiment of the E-Menu in which diners can type in a specific URL to visit a specific web site.

Figure 33 illustrates the split screen of a preferred 10 E-Menu that allows courses to be viewed simultaneously.

Figure 34 illustrates a photo screen of a menu item, provided according to a preferred embodiment of the E-menu of the present invention.

Figure 35 illustrates an E-Menu screen from which a 15 display filter may be applied to the menu items presented on the E-Menu.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention 20 will now be described with reference to Figs. 1-35 of the

drawings. Identical elements in the various figures are designated with the same reference numerals.

The Restaurant Automation System (RAS) represents a significant evolution in the applied technology and 5 improved processing for the service industry, and particularly for the restaurant industry. The Restaurant Automation System reflects current trends in consumer technology and Internet market space and provides benefits for both the consumer/diner and the restaurant industry.

10 The Restaurant Automation System is an overall system that gives the customer greater control over the dining experience, while decreasing expenses for the restaurant industry. Its most significant component is the E-Menu, a remarkable evolution of the traditional hard copy menu.

15 The E-Menu essentially allows a restaurant diner to transfer orders directly to the kitchen thereby bypassing the waiter, and ending the traditional waiter-dependency.

Herein lies a significant distinction between the Restaurant Automation System and other automation systems

20 that give only the waiter the means to automatically and wirelessly transfer table orders to the kitchen. Whereas there are benefits to be realized with this incremental

improvement in technology, from the customer's perspective the basic problem of waiter dependency is not abated. The E-Menu puts total control of the dining experience, from menu review to bill payment, in the hands of the customer.

5       There are other systems that allow the customer to directly interface with the kitchen, as described in the Background of the Invention, above. Most such systems are terminal based and involve a large terminal or Personal Computer (PC) like device that must be shared by customers  
10      at a table. Some use a cumbersome and impractical alphanumeric interface. None of these systems offer a device that is menu-like in its approach, feel, and interface. The E-Menu is essentially an electronic version of a traditional hard-copy menu as far as customer  
15      interfacing is concerned thereby requiring minimum transitional effort and streamlining the adoption process.

         The E-Menu leverages current trends in the consumer-oriented Information Technology (IT) market. With the increasing use of Personal Digital Assistants (PDAs),  
20      tablet PCs, and highly functional cellular phones as mobile instruments of Internet access, the E-Menu is designed to be familiar to the increasingly technology savvy

population. Yet, the E-Menu's human interface design allows it to be adopted easily by the general population. The E-Menu not only provides a direct interactive link to a restaurant's information database, but also serves as a 5 low-cost appliance for Internet access that is available to every restaurant customer.

Today's PDAs are increasingly providing integrated network and Internet access capabilities. However, PDAs are too small, and too expensive to replace the traditional 10 hard copy menu. Restaurant patrons are familiar with large menus that traditionally allow viewing at least two pages simultaneously, and that allow quick scanning of various dining courses at a glance. Today's new tablet PCs provide a large viewing area but are fully functional PCs and are 15 therefore too expensive and large to deploy to each diner.

The E-menu represents a low-cost, large display, interactive appliance suited for one specific function, and hence, produced at a low enough cost to justify its deployment to each restaurant patron.

20 The E-Menu can be used as an advertising medium to provide an additional revenue stream for the restaurant. In addition, the E-menu can display Internet web pages.

The fact that the Internet can be accessed from such a device in a restaurant will, in itself, serve to draw additional clients and increase revenue. Such restaurants may charge a premium for their food. Alternatively,  
5 incentive programs may be developed to increase revenue. For example, if a table's order exceeds \$50, Internet access is granted to that table. Or, Internet access may be provided if a certain special is ordered.

While the Restaurant Automation System (RAS) is a set  
10 of solutions designed to automate the restaurant industry, it is broadly applicable to many service oriented business operations. For the restaurant business, this automation will result in reduced operational costs and increased revenue. For the restaurant customer, use of the  
15 Restaurant Automation System will result in greater control over the dining experience and a faster, more efficient and more enjoyable dining experience.

The complete Restaurant Automation System is designed with four component systems (WCS, AOS, RMS, CPS), each of  
20 which may be separately tailored to the particular restaurant and which can be separately upgraded. The Restaurant Automation System permits and encourages the use

of a common pool of restaurant service personnel in contrast to the traditional model in which a particular waiter/waitress is designated to serve a group of tables. This alters the system to a single queue-multi server 5 system such as a bank queue, thereby reducing expected wait times for service. Additionally, this system ensures faster customer seating because the traditional round-robin seating rules used to fairly divide the customers among the waiters/waitresses is eliminated.

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General Architecture, Figures 1-4

Figure 1 illustrates the overall RAS product structure for a preferred embodiment of the Restaurant Automation System of the present invention. Figure 1 identifies the 15 four component systems of the RAS and their functions. The AOS is the core of the RAS. The WCS, RMS and CPS may be readily combined with the AOS, for greater efficiencies and profit. The components and functioning of the component systems will be described below in relation to the system 20 architecture.

Figure 2 depicts the overall architecture of a RAS. Note that all components depicted are located within a RAS equipped restaurant except for the Internet and the RAS

Central Service Center. The RAS coordinates the activities in a number of areas of the restaurant. The system depends on the RAS Compute Server, 1, which does the work of communicating between the various interactive displays and

5 E-Menus. The RAS Compute Server runs all the software applications and functional processes that provide the intelligence of the Restaurant Automation System within the restaurant and hosts the restaurant's central data store.

The infrastructure for communication between the RAS

10 Compute Server and the various displays and E-Menus is provided by means of a wireless network. This may be implemented using a wireless Local Area Network based on 802.11x standards, or may be based on wireless cellular technology. Within the dining area, 2, customers/diners,

15 3, are seated around the table, 4. The table is provided with a Table Call Unit, 5. Each of the customers/diners is provided with an E-menu, 6. The table may also be provided with a separate Table ID signal swipe/generator, 7. Using the Table Call Unit, the customers may summon a waiter at

20 will, but more particularly, may indicate to the service staff, a simple specific request such as a desire for more bread or another drink. Using the E-menus, each of the customers may explore the menu, requesting details on any

particular menu item, place and confirm an order, follow the status of an order, etc.

Within the food preparation or kitchen area, 8, the orders placed and confirmed via the E-menus are displayed 5 for preparation by restaurant staff. This Kitchen Order Display will be described in further detail below. The Automated Ordering System component of the RAS may also include a Payment Station, 9. The customer restaurant bills are presented for payment (by display, and with an 10 optional printout) at the Payment Station. The bills are tabulated at the request of the customer. The Payment Station will be described in greater detail below.

The overall RMS component of the Restaurant Automation System includes a Reception Display, 10, in the reception 15 area, 11 and a Reservation Display 10.1. At the Reception Display, customers without a reservation are permitted to enter a reservation, and perhaps to view a screen containing estimates of table wait time. At the Reservation Display, restaurant service staff may enter 20 reservations that customers have phoned in. The Reception and Reservation Displays will be described in further detail below.

The RAS Central Service Center 31 hosts the RAS Central Service Center personnel 32 who monitor the health, or functioning and effectiveness, of various RAS equipped restaurants by analyzing data that is fed from each 5 restaurant's RAS Compute Server. The RAS Central Server 33 maintains this consolidated information. The RAS Central Server also maintains consolidated information on frequent diners of RAS equipped restaurants in support of the Customer Personalization System.

10       Figure 3 illustrates one basic software alternative for the Restaurant Automation System architecture, illustrating its components and connections to other displays in the Restaurant Automation System. New applications can be easily added onto the Restaurant 15 Automation System compute server as new technologies are developed and/or new needs arise. It is the RAS compute server which accumulates the information regarding occupied tables and calculates expected table wait time for the Reception Display, based on orders placed, served, and 20 phone-in reservations. It is the RAS Compute Server that communicates the orders to the Kitchen Order Display, 8, and the total costs of the order to the Payment Station, 9. Preferably the RAS compute server is connected to a

broadband Internet service, which can provide Internet browsing on the E-menus via a Proxy Server function. All software and hardware functions in the E-Menu must be lightweight i.e., they must minimize use of memory space,

5 processing cycles, power, etc. One of the main success criteria of the E-Menu is that it be inexpensive enough to distribute to every diner. Only by efficiently designing software, minimizing licensing costs, and minimizing hardware costs, will a feasible cost target be attainable

10 for the E-Menu.

Note that the Figure depicts a TCP/IP and 802.11x based network. This may be implemented using a wireless Local Area Network based on 802.11x standards, or may be based on wireless cellular technology. The RAS is based on

15 wireless networking which may be implemented using any of a number of technologies.

Figure 4 illustrates an alternative architecture for the RAS that minimizes the hardware and software requirements on the E-Menu thereby minimizing its

20 development and production cost. In this approach, the E-Menu simply serves as an interactive display device without a Central Processing Unit (CPU).

Note that there are 2 implementation architectures that are proposed as depicted in Figures 3 and 4. Figure 3 depicts an architecture in which the E-Menu has a Central Processing Unit (CPU). In this alternative, the RAS

5 Compute Server transmits html pages and other data forms from its data store that represent the information requested from the E-Menu. This information is transmitted over the wireless network infrastructure to the requesting E-Menu device. The E-Menu's CPU interprets these html

10 pages (and other data forms) and converts them to a presentable graphical format that is then displayed on the E-Menu's LCD display by the graphics adapter.

Figure 4 depicts an architecture in which the E-Menu does not have a CPU. In this case, the process of

15 interpreting html pages (and other data forms) and converting them to a presentable graphical format is performed by the RAS Compute Server. The RAS Compute Server then transmits this pre-processed graphical data over the wireless network infrastructure to the E-Menu.

20 The graphics adapter in the E-Menu then presents this graphical data to the E-Menu's LCD display.

The advantage of the architecture depicted in Figure 3 lies in the fact that html pages (and other data forms) represent a relatively small amount of data that must be transmitted over the wireless network. Additionally, this 5 is a standard methodology used in web communications today. However, the disadvantage is that a CPU is required on the E-Menu to interpret these data forms and convert them to graphical information thereby increasing its cost. The advantage of the architecture depicted in Figure 4 lies in 10 the fact that since the data-form-to-graphics interpretation work is already done by the RAS Compute Server, a highly functional CPU is not necessary on the E-Menu. The E-Menu becomes a simple terminal display device. However, with this E-menu configuration a great deal of 15 graphical data must be transmitted over the wireless network infrastructure and this may result in which may affect performance. Also, the RAS Compute Server must bear the load of managing multiple E-Menu sessions and display directions. Hence, a more powerful RAS Compute Server 20 platform would be required.

Note that the Figure depicts a TCP/IP and 802.11x based network. This may be implemented using a wireless Local Area Network based on 802.11x standards, or may be

based on wireless cellular technology. The RAS is based on wireless networking which may be implemented using any of a number of technologies.

AS Common Functions

5 There are a number of underlying functions and resources provided by the RAS that are common to the four main component systems. These common functions include the data store, web server, Service Management function, and Configuration Function.

10 The data store may be a commercially available database, embedded database, open source code, or may be specifically developed for the RAS. The data store provides a common data repository of information that supports all the four main customer oriented functions  
15 (WCS, AOS, RMS, CPS). The data maintained in the data store on a restaurant's RAS compute server includes, but is not limited to, the following:

- Menu items, descriptions, photos, prices, etc.
- Hyper-links to sites advertising on E-Menus
- Data on closed service calls (time to call completion, table ID, etc)

- Reservation scheduling data
- Marketing information such as dishes ordered, web sites visited, length of meal, number of persons per party, etc.

5       • Error and performance information related to the restaurant's RAS system (transmitted regularly to data store on RAS Central Server).

A data store resident on the RAS Central Service

10      Center server includes, but is not limited to, the following data:

- Dining pattern information collected from various RAS equipped restaurants on frequent diners such as types of meals, dining frequency, dining geography, RAS customer ID, etc.
- Error and performance information across all RAS equipped restaurants

20       A web server running on each restaurant's RAS Compute server can provide standard access to the information in the underlying data store to the web browser function running on E-Menus. The web browser provides the common

data access mechanism for E-Menus and for the various interactive displays involved in the RAS. The software for this application may be commercially available software, open source code, or specifically designed for the E-Menu.

5

A common Service Management function running on the restaurant's RAS compute server monitors the health, or functioning and effectiveness, as well as the performance status of various components of the RAS compute server and 10 sends this data to the RAS Central Service Center Server's Service Management function. Here, the RAS Central Services Center personnel can analyze the data and take proactive remedial actions. The following lists some of the items that may be monitored by the Service Management 15 function:

- Restaurant's network utilization and performance rates, error rates, etc.
- RAS compute server disk, CPU, memory utilization
- Broadband link utilization

20 If the RAS Central Services Center personnel detect that something may impact service at a RAS equipped

restaurant, they may contact the restaurant's management or may dispatch a service technician to resolve the issue.

A common Configuration Function allows restaurant management to configure various aspects of the RAS system.

5 For example, for the AOS, the configuration function allows the restaurateur to update the menu items, descriptions, prices, photos, etc. quickly and easily. This is in contrast to traditional hard copy menus that must be reprinted when menu items or prices change. Daily specials  
10 may be changed daily electronically rather than by updating a chalkboard. For the RMS, the restaurateur may configure how long the restaurant should wait for a party that has a reservation before making their table available to other diners. The configuration function provides a simple  
15 Graphical User Interface (GUI) that allows data entry by any member of the common service staff pool.

As the Configuration function runs on the RAS Compute server, it can be accessed from any restaurant display including the Payment Station display or the Kitchen Order  
20 Display. The function should be password protected.

One frequently used function, the Menu Modify function, of the Configuration function is a process that allows the restaurant management to add/change/delete items, daily specials, descriptions, photos, pricing, etc.

5 on the menu.

Figure 5 depicts the main, or home, screen of the Menu Modify function. This screen allows restaurant management to select which part of the menu they want to update or if they want to create a new category or section in the menu.

10 Figure 6 depicts the Modify Screen that allows the actual update of information for a specific item in the menu. After changes are made, such as by simply typing in new information, restaurant management can save changes. The changes take effect immediately in the data store and  
15 the new information is available to diners via the E-Menu.

#### Waiter Call System

° One of the four components of the Restaurant Automation System is the Waiter Call System (WCS). The WCS  
20 provides a system by which a restaurant customer can efficiently call the attention of any member of the restaurant's service pool. The actual call process may

also provide an indication of what the customer desires thereby eliminating the inefficiency of the "double-trip". The WCS may be designed with an optional Call Status Display function that centralizes the display of all 5 customer service requests.

Figure 7 depicts the WCS Architecture. Its components are described below.

10 Table Call Unit

The basic unit of the Waiter Call System is the Table Call Unit (TCU). Figure 8 depicts the Waiter Call System Table Call Unit according to a preferred embodiment of the present invention. The TCU has several buttons, 12, 15 associated with the most frequently requested service functions. These can be interpreted to mean anything a particular restaurant determines suitable. For each button, a distinct color light or pattern is displayed in either a standard display, e.g. service call lights, 13, or 20 an attachable décor-integrated light display such as at 14, suitable for the restaurant. For the service staff scanning the dining floor, this gives an immediate indication not only of the fact that a particular table

requires service, but additionally, based on the color/pattern of the display, exactly what service is being requested. This eliminates the wasteful "double-trip" in which the waiter/waitress makes one trip to determine what

5 the diner wants and then another trip to satisfy the request.

Table 1 below provides an example implementation.

Button	Color displayed	Function
1	Orange	Service Personnel requested for inquiry, etc.
2	Blue	Water requested
3	White	Cash payment
4	Repeating blue pattern	Soda refill

10 The WCS table unit may contain an integrated timer with display, 15. When a service button is pressed, a timer is started that displays in seconds, the amount of time elapsed until the service call is fulfilled and the timer is manually stopped with the "end call" button. This

15 function serves as a quality of service gauge.

The Table Call Unit may also contain a Table ID transmitter/RFID swipe device 7 that transmits a unique table ID that is received by the Automated Ordering System's E-Menu units (described in next section). In 5 order to prevent one table's E-Menus from receiving the table ID transmissions from another table's transmitter, the transmitters may be set to a low power thereby requiring close proximity of the E-Menu in order to establish the table ID onto the E-Menu. This function of 10 setting a unique table ID on a table's E-Menus can alternatively be implemented by use of a Radio Frequency Identification (RFID) based means. This would allow an E-Menu to be swiped across an RFID unit that electro-magnetically affixes a unique table ID onto the E-Menu. If 15 the E-Menu is moved to another table, it is swiped at that table's RFID transceiver and all subsequent operations from that E-Menu are associated with the new table. If a restaurant implements both the Waiter Call System and the Automated Ordering System, this transmitter or RFID 20 transceiver is embedded in the Table Call Unit. If only the Automated Ordering System is implemented without the Waiter Call System, then the table ID transmitter/RFID transceiver means is affixed to or embedded within the

dining table. The Table ID transmitter/RFID swipe device is modular so that it may be plugged into or removed from the TCU or the table easily.

As will be discussed in the next section, a modular wireless means is also used in the TCU for restaurants that have the optional Call Status Display. This wireless means allows transmission of call request data to the RAS Compute Server (or alternatively, directly to the Call Status Display if the AOS/RAS compute server are not subscribed) which then relays it to the Call Status Display(s). This wireless means is modular so that it may be easily plugged into or removed from the TCU.

#### Call Status Display Option

The Waiter Call System with the lighted Table Call Unit display is well suited for open spaced dining areas that can be scanned easily for the Table Call Unit lights or where there are a large number of service personnel. In restaurants that have partitioned seating areas or where the dining floor contains secluded sections, it may be difficult for service personnel to scan all areas easily and respond quickly. In such environments, it may be appropriate to supplement or substitute the lighted Table

Call Unit displays with one or more Call Status Displays, such as at 16 in Figure 9 that would be located at a position(s) in the restaurant easily viewable by the service personnel. This is a RAS Compute Server-based 5 function that can be monitored via the Call Status Display(s) throughout the restaurant. In this preferred embodiment the function and display provide an easily viewed Graphical User Interface (GUI), 17, that displays the service call status of all tables. Colors reflect the 10 amount of time that has elapsed since the customer request and hence, the urgency of responding. Touching the screen at a particular location, such as at "end call" may produce a particular result such as deleting the service request line from the display and entering data about the request 15 such as type, table ID, time to completing request, etc. into the RAS Compute Server's data store. Pressing the end-call button 17.1 on the TCU has the same effect. Reports can then be generated from this stored data that can be used by the restaurateur to help identify service 20 issues.

If the Call Status Display is used, it is necessary to introduce a wireless communications means within the Table Call Unit. This wireless communications link is used to

communicate data related to the service request to the RAS Compute Server over the wireless network infrastructure.

The RAS Compute Server then transmits this information to the Call Status Display(s).

5        It is also possible to implement the WCS with the TCU and a Call Status Display but without the RAS compute server. In such an implementation, pressing a service button on the TCU generates a wireless transmission to the Call Status Display directly where all service calls can be monitored. In this case, the Call Status Display has a wireless receiver, LCD touch display, memory, and intelligence to display the service calls and delete them when the "end call" button is pressed. Since there is no RAS compute server involved, the benefits of service call data collection and reporting are not available.

10

15

#### WCS Function

The WCS function resides on the restaurant's RAS compute server. When a table makes a service request via the Table Call Unit, the TCUs wireless interface sends the request to the WCS function. The WCS function forwards the request information (table ID, type of request, etc.) to the Call Status Display. When the service call is

20

fulfilled and the "end call" button is pressed either on the Call Status display or on the TCU, a message is conveyed to the WCS function to remove the service call information from the Call Status Display and saves the 5 request information in the data store for future service reporting/analysis.

As previously mentioned, the WCS function runs on the RAS compute server and hence, is applicable when the WCS system is implemented with the RAS compute server. It is 10 possible to have the TCU directly transmit to the Call Status Display without the WCS function. In this case, the benefits of tracking service call data and reporting would not be available.

## 15 WCS Process Flow

Figure 10 depicts the process flow associated with the Waiter Call System. As shown, when the customer requires service they may use the service call buttons, 12, of the Table Call Unit to indicate a request for water, cash 20 payment, or some other designated service. The Table Call Unit and/or the Central Call Status Display(s) alert the service staff to complete the request. Thereafter, the "end call" button may be pressed on the Table Call Unit

and/or the Call Status Display. Data related to the call is then stored in the RAS compute server's data store for future analysis/reporting (if implemented in conjunction with the RAS compute server).

5

#### Automated Ordering System

The most preferred Automated Ordering System (AOS) of the present invention consists of five main components: the E-Menu, the Table ID transmitter/RFID swipe device, Kitchen 10 Order Display, the Payment Station, and the Automated Ordering System function, 18, residing on the RAS Compute Server. Figure 11 depicts the Automated Ordering System architecture.

In the Automated Ordering System, the traditional hard 15 copy menu is replaced with a hand held electronic device with a large touch sensitive LCD display. This device, called an E-Menu, is a low cost electronic appliance that provides diners access to a database of rich content information residing on the RAS Compute Server. This 20 information includes the menu, photos of menu selections, information on the restaurant, chef background, nutritional information, call status information, access to web servers, etc.

The Automated Ordering System function provides various functions to the diners by coordinating and processing input placed by diners via the E-Menu and various interactive displays throughout the restaurant.

- 5 For example, the AOS generates orders for the kitchen and displays the orders on the Kitchen Order Display, processes billing, interacts with the Payment Station to settle bills, etc. The Automated Ordering System function may also maintain food preparation status information that can
- 10 be easily viewed by the diners on the E-Menu. This may facilitate a desired order change. Wireless networking technology is used as the communications infrastructure between the various components of the Automated Ordering System.

15

#### E-Menu

The E-Menu is one of the core components of the Automated Ordering System. The E-Menu is a low-cost, large touch sensitive display, appliance with built-in wireless networking and rechargeable power source. The E-Menu serves as the diner's primary interface to the Automated Ordering System.

- 20

Figure 12 depicts a possible implementation of the E-Menu, 6, with the large interactive touch screen display, 20, and embedded wireless networking interface, 21. Preferably the E-menu /also has brightness/contrast controls, 22, readily accessible by the customer/diner, and an optional pointing device, 23, which may be used on the touch screen, 20. The charging system for the E-menu has a low battery indicator, 24 and battery charging contacts, 25.

10

The E-Menu consists of the following essential hardware (specifics are subject to change depending on the method of implementation):

- 15     • Large touch screen display (b/w or color)
- Video display adapter
- Memory (either RAM or video memory onboard video adapter depending on implementation)
- Rechargeable power source
- 20     • Low battery indicator
- Battery charging interface/contacts
- Integrated wireless communication interface
- Brightness/contrast controls

- Pointing device
- An interface that allows for firmware upgrades (not shown in picture - this may be performed via wireless network interface)

5     • May contain a Central Processing Unit (CPU) depending on implementation

- Reset button
- RFID receiver or electromagnetic means of receiving table ID

10

There are two primary methods of implementation envisioned for the E-Menu as described in the discussion on the software architecture alternatives in relation to Figures 1-4. First, the E-Menu may contain a CPU. In this 15 case, the E-Menu may run a light operating system that minimally serves the purpose of the E-Menu device. This may be a commercially available operating systems such as Microsoft's Pocket PC ®, 3Com's Palm OS ®, a commercially available embedded operating system, open source code, or 20 may be specifically developed for the E-Menu. The E-Menu may run a web browser function which is also a light function that communicates with the Automated Ordering System server function via the RAS compute server's web

server over a wireless network and a standard protocol such as HTTP and graphically presents html page information from the Automated Ordering System function to the diner.

5       The E-Menu may alternatively be implemented as a light "display client" that has no CPU or noteworthy operating system. In this case, the E-Menu's main components would consist of a wireless network interface, touch sensitive LCD display, and a video adapter. In this implementation,  
10      the RAS Compute Server would assume the responsibility of interpreting html and other data forms into a graphical file that would be sent over the wireless network to the E-Menu that would then simply display the graphics file to the diner. For a discussion of the advantages and  
15      disadvantages of each implementation approach, see the discussion on software architecture alternatives in relation to Figures 1-4.

20      The main intelligence of the Automated Ordering System resides in the Automated Ordering System function running on the RAS Compute Server. The E-Menu simply provides a platform by which customers access the Automated Ordering System function and the data in its underlying database.

The Automated Ordering System function allows diners to categorically (e.g., by vegetarian, chicken only, seafood only, price range, etc.) filter the display of menu items.

The E-Menu presents and displays this information to the

5 customer and allows the customer to navigate through the Automated Ordering System functions. The Filter Display function accessed from the E-Menu is displayed in Figure 35.

10 The E-Menu provides flexible viewing options that for example, allow two meal courses, or sub-menus, to be viewed at once by dividing the screen into two sections. This allows easy comparison of, for example, appetizer items and main course items. Figure 33 depicts this function. With

15 this function, the diner may bring up a window for each course, and scroll through the offerings, while viewing the selections for another course in another window. While the definition of courses may differ from restaurant to restaurant, and menu to menu, what is intended by this

20 function is to achieve a scrollable window for each sub-menu or section of the menu. In fact, each hyperlink in the E-menu can bring up a new window.

The price of the E-Menu must be kept minimal and its performance must be maximized for its cost. To this end, it is preferred that all extraneous functionality and processing is eliminated from the E-Menu thereby making it 5 an appliance type of device.

Each E-Menu contains a means of receiving a Table ID from a Table ID transmitter/RFID swipe device that is either embedded in the Waiter Call System's Table Call Unit 10 as previously described or embedded/affixed to the table as an independent device. This Table ID is then sent along with the individual's order in the transmission to the AOS function where it is collated with other orders from the table. If an E-Menu is handed to someone else at another 15 table, it can pick up the new table's ID signal via proximity to the signal source or via swiping across an RFID transceiver.

The E-Menu demonstrates physical tolerances 20 appropriate for the environment in which it is used. It shall withstand hot and cold liquid spills, vibrations, drops, food spills, etc. The E-Menu provides a display brightness and contrast adjustment control to facilitate

viewing in dark restaurants or in well lit or street side facilities. The E-Menu interface and selection buttons are sized appropriately for use by human fingers. However, a touch screen pointing device, 23, is also provided as an 5 attachment on the E-Menu for those who prefer this option.

One of the primary concerns of the E-Menu is that is look and feel like a traditional hard-copy menu. The E-Menu provides a simple, flowing interactive process that 10 facilitates its use and adoption. The size, user interface, and other human interface characteristics are designed to serve this end.

In fact, the new foldable LCD screen would assist in 15 creating an E-menu that, at first glace looks like a hard copy menu, but contains many layers of information. Foldable color LCD displays have been introduced by a number of manufacturers. Most use plastic polymer semiconductors instead of silicon. Toshiba and NEC/Samsung 20 have introduced foldable PC monitors. The NEC/Samsung model has an acrylic screen and a flexible frame. Surprisingly, the cost of the foldable LCD monitors is about the same as for the older flat LCD screens. Samsung

was the first to introduce foldable LCD screens. Their 8.4-inch monochrome display which was showcased at the Korea e-book industry tradeshow in April 2002. Unlike NEC-Mitsubishi's collapsible offerings that are targeted at 5 desktop users, Samsung's Black and White monitor is meant as a display for electronic books. In light of its niche application, the 8.4-inch screen uses Cholesteric LCD technology, a feature that allows the monitor to retain images even without a power supply. Though this might be 10 sufficient for certain restaurant menus, many restaurants will want full color menus.

For those customers that prefer a traditional dining process, the E-Menu can be used as a traditional menu for 15 the purpose of viewing items, descriptions, etc. For order placement, the customer may request that a member of the service staff place the order via an E-Menu on his behalf. The bill payment process can also be handed to the service staff for administration. Thus, the AOS accommodates 20 diners who want to leverage the benefits of the automation system and gracefully accommodates diners who prefer a more traditional dining process.

At the same time, the E-Menu provides functions that cannot be provided by a traditional hard-copy menu. For example, the E-Menu allows diners to view photos of the menu items, allows for flexible billing options, provides

5 background information on the chef, serves as an advertising platform, etc. These functions are integrated into the E-Menu user interface in a manner that is non-intrusive to its core function of placing food orders and yet, are easily accessible when desired. Each diner is

10 thus simultaneously provided with a wealth of information, and the ability to place an order. This point is in contrast to other proposals that require multiple diners at a table to sequentially interact with a table based ordering system that is not menu-like in its approach but

15 rather, bulky and computer-like. Additionally, these systems require the individual diners at the table to wait for their turn to view the menu information and place orders.

20 Table ID Transmitter/RFID Swipe Device

The Table ID transmitter/RFID swipe device interacts with the E-Menu by assigning a table ID to the E-Menu. This may be achieved via electronic, electromagnetic, radio

frequency, or other means. If the restaurant is equipped with the Waiter Call System, then the Table ID transmitter/RFID swipe device may be embedded within the Table Call Unit. If the restaurant has not subscribed to 5 the Waiter Call System, the Table ID transmitter/RFID swipe device may be embedded/affixed to the table itself.

The physical distance required between the E-Menu and the Table ID transmitter/RFID swipe device in order to 10 effect setting of the table ID on the E-Menu must be relatively small. This ensures that the table ID will not be picked up by E-Menus at other tables.

Whether a proximity based transmission is used or a 15 swipe device will depend to some extent on the table layout of the restaurant. Table proximity and positioning will be factors in this decision.

The Table ID transmitter/RFID swipe device is 20 preferably a modular unit that can be plugged into or removed from the TCU. It may also be plugged into or removed from a table base unit that is affixed to or embedded within a table. This allows easy transition for

restaurants that have subscribed to the AOS and want to add the WCS, or for restaurants that want to change their tables.

5 Kitchen Order Display

The Kitchen Order Display receives confirmed orders from the AOS function. The AOS function transmits confirmed orders along with the associated table ID to the Kitchen Order Display for the kitchen staff to view. Based 10 on the floor plan and/or size of the kitchen, there may be more than one Kitchen Order Display. Figure 13 illustrates an order screen such as would be displayed on the Kitchen Order Display, 26.

15 Because many orders may arrive in a short time during busy periods, the Kitchen Order Display may be implemented using a display that is longer in height than in width thereby allowing a greater number of orders to be simultaneously displayed. A printer may be attached to the 20 Kitchen Order Display via a cable or wireless means.

The AOS function manages how orders are displayed. For example, when individual orders start arriving from a

table for a particular meal course in a short time window, the AOS function attempts to collate them on the Kitchen Order Display. If a late order arrives from the same table, the AOS will attempt to place the order at the end 5 of that table's order on the display and will flash the order in a distinct color. The AOS function may remove from the display the oldest orders, for which preparation has started.

10 When the chef starts preparation for an individual order, he may press the "Prep Started" button to indicate to the AOS function that it is now too late for the customer to change/cancel the order. This information will be displayed to the customer on his E-Menu by accessing the 15 "Order Status" function on the E-Menu. Until the chef presses the "Prep Started" button, the customer may access his order from the E-Menu and change/cancel the order. This change will be reflected by the AOS function on the Kitchen Order Display.

20

The chef may also choose to print a particular order by pressing the "Print Table Order" button.

Payment Station

The Automated Ordering System function also provides a billing function that takes a table's order information, generates a bill, and sends the information to a Payment 5 Station where diners can make payment.

The Payment Station may be provided with a touch screen interface through which diners can identify their table, print a bill, and make credit-card payment. The 10 Payment Station may consist of a processor with a wireless network interface and a touch screen monitor as depicted in Figure 14. Alternatively, the Payment Station may be a light "display client" with a video adapter, large touch sensitive screen, and wireless network interface. The 15 Payment Station may also provide a credit card swipe device with a built-in printer and electronic signature capture means so the restaurant does not need to physically track signed receipts.

20 Cash payment can be made to a member of the service staff. A cash payment request button may be one of the buttons on the Table Call Unit of the Waiter Call System. (The traditional method of calling a waiter's attention

must be used if the WCS has not been subscribed). In addition, a member of the restaurant common service pool may access a password protected "cash payment" function accessible on the Payment Station display. After

5 depositing the cash and removing change, the service personnel may then indicate that the table's bill has been settled via the Payment Station's touch screen.

Alternatively, a specific cash Payment Station may be used that is located in an area not accessible by customers.

10 Once payment is made, this information is fed back to the AOS function that then updates the table status in other functions such as the Reception Management System discussed later. Figure 15 depicts the process flow associated with cash payment.

15

A Table Payment Status screen can be accessed via a password protected function on the Payment Station display (or a dedicated Payment Station only accessible to restaurant staff). The Table Payment Status screen, 20 accessible at the Payment Station 9 displays the following payment states associated with tables:

- Payment pending

- Partial payment made (in cases of multiple bills per table)
- Payment made and subsequent order
- Payment settled

5

Display colors may be associated with each state to provide a quick assessment of the payment state of occupied tables. For example, Payment Pending may be indicated in red while Payment Settled may be indicated in green.

10

The Table Payment Status screen is depicted in Figure 16

Bill Payment can also be made in the traditional manner by a member of the restaurant's common service pool at the request of the customer if so desired. In this 15 case, the customer can call the service pool via the Table Call Unit (if equipped) and then give his credit card or cash for the service personnel to administer the payment process.

20 The number of Payment Stations at a restaurant will depend on the establishment's floor space, situational scenario, cost, etc. At minimum, a single Payment Station

is required. However, each table could have its own Payment Station.

AOS Function

5 The AOS function coordinates the interaction between E-Menus, the Kitchen Order Display(s), and Payment Station(s).

10 The Automated Ordering System function sits atop a data store, 27 in Figures 3 and 4, and accesses data that is related to its function. The AOS function maintains active data related to all aspects of a table's dining status from the point a party arrives at a table to the point that all bills have been settled and the party 15 leaves. The AOS function also accesses and presents less dynamic information in the data store such as menu items, photos, chef background, etc.

20 The Automated Ordering System application provides functions available to the diner that are accessed via the E-Menu. Diners can place orders via the E-Menu. The Automated Ordering System application maintains a record of items ordered by individuals and by the table as a whole

and also maintains billing information according to the desired billing policy for the table. The Automated Ordering System application also makes status information on food preparation input by the cooking staff available to 5 diners. Diners can also update, cancel, or change orders after they are placed providing a real-time degree of ordering flexibility.

The AOS also allows data from the data store to be 10 requested and presented in certain ways. For example, a Filter Display function accessible from the E-Menu allows the menu data to be filtered based on specific criteria such as vegetarian, kosher, chicken only, by price range, etc. This function is depicted in Figure 35.

15

An automated billing process is incorporated into the Automated Ordering System. Automated billing allows a party to pay its bill(s) at any time during the meal. Customers do not need to wait for the check or for anyone 20 to swipe credit cards and return, etc. This allows customers to leave immediately after completing their meal if they wish.

When a diner decides to pay the bill, he/she makes an indication on the E-Menu (or walks to an Payment station and enters his/her table number on the user interface). This request is sent to the Automated Ordering System 5 function that totals the table's bill according to the billing policy for the table and sends this information to the Payment Stations. Figure 17 depicts the Process Flow associated with a diner making a credit card payment for the table.

10

Various billing policies may be implemented in which a single or a number of separate bills per table may be requested. The default operation assumes that there will be a single bill associated with the table order. No 15 action needs to be performed by any diner to establish this billing policy that reflects the vast majority of billing situations. In the exceptional case that individuals at a table want a separate bill for their own orders (as for some business meals in which individual receipts are 20 required for expense purposes), each diner may interact with an option available on the AOS function via the E-Menu that, at order confirmation, allows the diner to associate the order with a distinct bill. The Automated Ordering

System function keeps track of the various individual orders from the table and associates an identifier with each individual order along with the table that it comes from forming a table/individual order ID (e.g., 4b 5 represents an order from individual b, at table 4). When the AOS Application sends a confirmation of the individual order back to the E-Menu, the table/individual identifier is also sent. When an individual diner picks up an E-Menu and appends to his/her order (e.g. dessert/coffee), the 10 Automated Ordering System Application may ask the diner for the table/individual ID to which to append to. In case the individual has forgotten the ID, he/she may request that the AOS Application display all orders from the table from which he/she may then select his/her order to append to.

15 Hence, the entire process works as it does for simple collective table billing, but may have one greater degree of resolution (introduction of the individual identifier).

Figure 18 depicts the process flow for tables 20 involving individual billing. For tables at which at least one diner has requested an individual bill, payment is handled by using the table/individual ID. The individual may pick up an E-Menu and send a request to the AOS

Application that his/her bill be tallied based on the table/individual ID (or he/she may walk up to a Payment Station and make the same request). The diner may then go to the Payment Station, review his/her bill, and make 5 payment. At the Payment Station, the diners can pay their bills via credit card and can print a receipt.

It should be noted that the restaurant staff may provide adjustments to a bill. For instance, a printout of 10 a complementary order of after-dinner drinks may appear on the bill. In another example, a discount may be applied to a bill, to illustrate to the diner the benefits of a particular dining program. In order to apply the adjustment, a member of the restaurant staff, using an 15 enabling pass-code for bill adjustments, may apply the adjustment to the bill using another E-menu, or the Reservation Display, or other access to the server, or directly to the payment station.

20 The restaurant staff is made aware that payment has been made for a table. This notification is reflected on the Table Payment Status screen on a Payment Station display, which can display the payment status of all

tables. Access to this screen may be password protected or it may be physically accessible only by restaurant staff. Colors could be used to reflect the payment status of each table. The Table Payment Status screen is depicted in 5 Figure 16.

The Automated Ordering System allows diners to place orders after payment has been made and alerts the restaurant staff that billing will be made for additional 10 items. This accommodates diners that change their minds after payment and decide to have, for example, dessert or coffee. Diners will need to make another payment for these additional items. Placing an order after payment for the table (or individual) payment has been made changes the 15 payment status of the table to, i.e. "Payment with Subsequent Order".

#### AOS Process Flow

Figure 19 depicts a simplified process flow for a 20 party of three ordering a meal in a professional oriented restaurant where it is assumed that diners can order quickly and easily. There are a number of ways to address the concept of confirming the table order. First, there

may be no confirmation (as in Figure 19). As each diner at a table sends his/her individual confirmed order, it is received by the AOS Application on the RAS Compute Server and subsequently displayed on the Kitchen Order Display.

- 5 As each individual order is received, it is correlated with other orders from that table and displayed collectively on the Kitchen Order Display. This method works well in environments that cater to professional diners who can responsibly place and confirm their individual orders
- 10 within a focused time frame so that all individual orders are displayed in the kitchen at approximately the same time.

In a preferred embodiment, the E-menus may be provided

- 15 with a means to disable the "sent order" function. This would be advantageous in the instance when a parent wants to order for a child and thereby prevent any erroneous orders from the child menu. This could be accomplished by a disable button on the E-menu, which could be pressed by
- 20 the waiter, seater, or parent. Alternative means could comprise a password protected disable function. There are many ways of accomplishing this disabling of the order send function, which will be known to those skilled in the art

Figure 20 depicts an alternative approach that involves designating a single E-Menu at a table as the "confirmmer" E-Menu. This may be the first E-Menu swiped at 5 the Table ID signal transmitter/RFID swipe device. A unique E-Menu ID is then transmitted to the AOS function identifying it as the "confirmmer" E-Menu for the table. This E-Menu can then be handed to the table's "head" diner (the one responsible for payment, or based on some other 10 criteria). After all individuals place their confirmed orders with the RAS Compute Server's AOS function (with the "head" diner's order being the final one and indicating that all individual orders have been placed), the AOS function sends the entire table order to the table's 15 "confirmmer" E-Menu for final confirmation of the table order. This method is suitable for family oriented restaurants where a parent's final authorization/confirmation is required before an order is accepted and sent to the Kitchen Order Display. If changes 20 need to be made by the "head" diner (e.g., deletion of multiple ice cream orders), he may do so and then send the final approved table order.

An alternative for the family restaurant involves providing a means of disabling the "send order" function temporarily on certain menus - perhaps the ones given to children. Hence, the children are granted all E-Menu 5 functionality but cannot send confirmed orders. It is the parent's responsibility to collect and send confirmed table orders. Finally, a simple approach to family restaurants involves not providing E-Menus to children at all.

10 Reception Management System

The Reception Management System (RMS) functionally sits atop the Automated Ordering System. The RMS function uses input from the Reservation and Reception displays and leverages data from the AOS function to generate estimates 15 of table wait times and presents these wait times to arriving customers. Arriving customers can then decide if they want to wait for a table or leave. If they decide to wait for a table, the RMS function allows them to enter their names into electronically displayed queues via the 20 Reception Display. The RMS function also interacts with a Reservation Display that accepts phone-in reservations and coordinates these reservations with table requests made via the Reception Display.

The RMS function uses table request inputs from "walk-in" customers and reservation inputs, and uses AOS table state information to determine table allocation. Once a 5 table is available, the RMS function may utilize various methods of calling waiting customers. The RMS may optionally implement a mapping application that highlights available tables on a restaurant map and allows customers to seat themselves. This mapping application also depicts 10 the restaurant layout, identifies tables and booths, table numbers, etc. so that walk-in customers can specify preference for a particular table.

The Reception Management System function, 28 in 15 Figures 3 and 4, also runs on the RAS Compute Server that hosts the Automated Ordering System function

Figure 21 depicts the Reception Management System 20 architecture.

#### Reception Display

The Reception Display is located in the restaurant's reception area. It is the primary point of interaction for customers arriving at a full restaurant. The Reception

Display consists of a large touch screen display and a wireless communications interface. It may also contain a sound card and a speaker.

5       Figure 22 depicts the Table Wait Time Summary screen provided to customers at the Reception Display. This preferred Reception Display uses colors to reflect expected wait times. For example, red may be associated with tables with the longest wait times and green may be associated  
10      with those with the shortest wait times. The summary screen provides, at a glance, the expected wait times associated with tables of various sizes. This wait time information is based on data from the AOS active table state information as described below (in RMS Function  
15      section).

If a potential customer decides he/she wants to wait for a table, he can press the "reserve" button, 29 in Figure 22, and bring up the Reception Display's Join Queue  
20      screen depicted in Figure 23, and enter his/her name as indicated. The Reception Display provides a "soft keyboard" through which customers may enter name information into the queue.

### Reservation Display

Many restaurants have existing systems that allow for call-in reservations or manually handle call-in

reservations via paper schedule. The Reception Management

5 System provides a dedicated display interface that allows restaurant staff to accept call-in reservations and enter them into a graphical scheduling interface.

10 The Reservation Display is accessible to the restaurant staff who receive phone-in reservations. The Reservation Display consists of a touch sensitive display and a wireless communications interface.

15 The Reservation Display shows the same information that is shown on the Reception Display and additionally provides access to a scheduling function that allows the staff to enter reservations that have been phoned-in. This call-in reservation information is stored in the RMS data store on the RAS compute server. When new customers arrive

20 and interface with the Reception Display, the RMS incorporates call-in reservation information into its scheduling and table assignments by blocking off tables during the times for which they are reserved. If the party

with the reservation does not show up in a prescribed time frame, the RMS function automatically releases the table for availability.

5       Information from the Reception Display is useful to the restaurant reservation staff because it provides data on the short term availability of tables for those phone-ins that request relatively immediate reservations.

10      RMS Function

The RMS function resides on the RAS Compute server uses the AOS function's data store of active table state data. For example, the RMS function uses the following information from the AOS function to determine the expected 15 wait time for an occupied table to clear.

1. Number of persons at table
2. Appetizers ordered?
3. Main course ordered?
4. Deserts ordered?
5. Bill requested?
6. Bill payment status

The RMS function considers this information and then may add a factor for the time needed to clean and prepare the table for the next party.

- 5        The RMS function is primarily a scheduling system. The RMS system receives input from the Reservation Display at which restaurant staff input reservation requests from customers who call in advance. These call-in reservations block off windows of time for tables of a specific size in
- 10      the restaurant's schedule. The RMS function also receives input from the Reception Display at which customers without reservations make immediate requests for a table of a specific size. The RMS function uses these inputs, scheduling algorithms, and the AOS function's table state
- 15      information to estimate wait times for tables. The RMS functions algorithms are intelligent enough to assign a table for 4 to a party of 2 or 3, a table for 6 to a party of 4 or 5, and so on based on current table utilization rate rates.

20

These estimated wait times are displayed on the Reception Display for entering customers. Immediate table requests made at the Reception Display block off short-term

time windows that affect call-in reservations. The  
restaurant staff accepting call-in reservations is provided  
the information from the Reception Display at the  
Reservation Display. Hence, call-in reservations limit  
5 table availability for walk-ins at the Reception Display  
and walk-ins entering table queues at the Reception display  
limit short-term table availability for those calling in.

Once a table becomes available, as identified by the  
10 bill being settled and the party leaving, the service staff  
can access the Table Status Display and interact with a  
touch screen function that sets the table status to  
"Available". This table status is then passed to the RMS  
function. The RMS function may call the first party in the  
15 queue that can be seated at that table size using various  
methods. First, a recording may call "Table for party of 4  
ready" repeatedly for a predetermined period of time and  
may flash the name of party on the screen (this also  
assists the service staff in identifying the party).  
20 Alternatively, the RMS function may interface with existing  
flasher/buzzer devices that customers carry with them until  
their tables are ready. The RMS function may be notified  
that the party has been seated when the table registers an

E-Menu at the table or when an indication is made by the service staff on the Reservation Display. A member of the service staff may accompany the party to their table. If a party does not arrive in a pre-determined timeframe, the

5 RMS system may move on the next party in the queue.

The Reception Management System may also provide an optional mapping application that displays the floor and table layout of the dining area. This allows new customers

10 to determine the location of tables and to specify preferences for specific tables. When a table becomes available, customers can determine where to go thereby eliminating the need for the service staff to accompany them. The mapping application also displays the number of

15 the available table. Each table at a RAS equipped restaurant may also have a numeric display to facilitate finding the table. Finally, if the table is equipped with a TCU, and the RMS function receives notice that a table has become available and calls the waiting party, it may

20 send a signal to the table's TCU unit, to emit a signal such as a pattern of light flashes thereby making it easier to find for the diners.

### RMS Process Flow Concept

Figure 24 depicts the process a "walk-in" customer entering a restaurant would follow to make a reservation after deciding that he wants to wait for a table. Once the 5 RMS identifies that a table has become available for a party of a particular size, various methods of calling the party may be implemented including using voice calling or interfacing to a buzzer system as described above.

10 Once the party has been identified, a member of the common service staff may direct the party to the table or a mapping application may be used to extend the RMS functionality as described above.

### Customer Personalization System

15 The Customer Personalization System addresses concerns that the RAS may be impersonal and that it removes the personalization that a waiter can provide. The CPS function residing on the restaurant's RAS compute server 20 maintains a data store of customer IDs of those who choose to participate in the CPS program. CPS provides a high level of meal behavior tracking and provides benefits to

RAS restaurant customers at a level that is not possible by individual waiters.

The core of the CPS operates centrally at the RAS

5 Central Service Center and thereby can track meal patterns and preferences for customers based on a customer ID over all RAS equipped restaurants. The CPS can then apply focused advertising via the E-Menu and discount benefits automatically to patrons that exhibit certain dining

10 patterns or provide a certain level of patronage. The CPS thereby provides a powerful means by which the restaurant industry can attract and retain more patrons and provide advertising and marketing channels.

15 The Automated Ordering System function maintains data on customer dining patterns such as types of meals ordered, patronage frequency, etc. in its data store. This information can also be shared with information from other RAS restaurants and compiled at the RAS Central Service

20 Center over an Internet or dial up link. Hence, customer specific information can be collected across many RAS equipped restaurants. This information can be used to personalize service for specific customers. For example, a customer who shows a pattern of consuming kosher meals can

be sent specific recommendations and meal suggestions or can be sent specific hyperlinks to advertiser's website to internet sites for kosher restaurants or services.

Customers may be identified by a specific RAS customer ID.

5 Figure 25 depicts the CPS Architecture.

CPS function on Restaurant RAS Compute Server

When CPS participants enter a RAS equipped restaurant, they may walk up to a Payment Station and access the CPS function. In the CPS function, they may enter their customer ID and table number. The CPS function on the restaurant's RAS compute server then accesses the customer's data from the RAS Central server at the RAS Central Service facility. The primary data retrieved are:

15 1) the customer's membership level which indicates a level of patronage of money spent at RAS restaurants and 2) any preferences for food types (kosher, vegetarian, etc).

Other data may also be retrieved. Based on this information, the restaurant's CPS function may focus 20 specific advertising to the E-Menu's at the customer's table or call attention to specific items that may be of interest. Additionally, the RAS system may have arrangements with special interest organizations and

marketers, etc. that may want to direct focused advertising to specific groups via the E-Menu platform. This may provide an additional revenue stream for the restaurant industry. Additionally, when the customer initiates the 5 bill payment process, the AOS function queries the CPS function to see if the table qualifies for discounts. The CPS function will use the customer's patronage level to determine a discount level and forward this to the AOS function's billing process. The discounted bill is then 10 sent to the Payment Station.

#### CPS Function on RAS Central Server

The CPS function on the RAS central server maintains the central repository of all frequent RAS restaurant diner 15 information such as:

- Customer IDs
- Patronage level
- Cuisine preference

20

Other data may also be maintained. The RAS central server receives this information regularly from RAS equipped restaurants via the Internet or dial up means -

either on an event-by-event basis or via daily or weekly uploads. The RAS Central server dispenses this information to a RAS restaurant when a frequent CPS customer enters his customer ID at a Payment Station and the restaurant's RAS

5 compute server makes a request to the RAS central server. The RAS Central server then downloads the customer patronage level and cuisine preference information to the restaurant's RAS compute server via the Internet or dial up means. This information is then used for specific

10 advertising/marketing activities via the E-Menu and for applying discounts as described above.

As described in the previous section, there may be customers who decide to proactively participate in and

15 become members of the CPS frequent diner function. These customers are assigned a customer ID. However, there may be customers who choose not to proactively participate in the CPS function or who do not know of it. These customers may frequently dine at RAS restaurants. To provide an

20 automated benefit to these customers, the CPS function on the RAS central server tracks bill payment by credit card number. Each time a customer dines and makes a credit card payment, the credit card information, meals ordered, etc.

information is stored on the restaurant's RAS Compute server as described in the AOS function section. This information is regularly uploaded to the RAS central server. The RAS central server has intelligent processes that scan through this data and can identify customers based on credit card numbers, which may qualify for specific discounts based on their dining frequency. When the RAS Central server identifies that someone qualifies for a discount, it performs a broadcast download of the credit card information to the RAS compute servers of all RAS equipped restaurants. The RAS compute servers of the restaurants maintain this frequent diner credit card number in a table within its data store. When that specific customer dines at a RAS restaurant and swipes his credit card during the payment process, the AOS function queries the CPS function to see if the credit card is in the frequent diner list. If it is, the CPS function returns a discount value as suggested by the RAS central server.

Hence, this system offers a novel method of granting frequent diner benefits completely automatically with no customer involvement or intervention.

#### CPS Process Flow

Figure 26 depicts the process flow associated with the CPS function for a customer who participates in the CPS function and has a customer ID. Note that for a customer who does not participate in the CPS function, as the 5 customer swipes his credit card to pay for their meal, the CPS function would automatically detect the customer's dining frequency and habits and apply the appropriate benefits, such as discounts.

10 E-Menu Screens

Figure 27 depicts a sample home screen. This is the first screen that would be presented on an E-Menu to a diner. It provides the choice of viewing the menu or accessing the Internet.

15

Figure 28 depicts the main menu screen from which diners can navigate into sub menus for particular meal courses.

20 Figure 29 depicts the home screen for Internet surfing. A diner can choose pre-defined sites thereby eliminating the need to enter an URL address or can open a browser and type a specific address.

Figure 30 depicts a pop-up detailed description screen that provides more information on a particular menu choice.

Figure 31 depicts a sub menu for a particular meal 5 course e.g., wine list. Note that a running "Your Order" screen, 30, is provided that maintains a list of items the diner has placed on his order. When ordering off a submenu, the touch-screen selection provides a vast improvement over prior automated ordering system that 10 required diners to correctly enter the codes or numbers that are associated with the desired item. The requirement to enter such designators only provides a chance to make an error, and unnecessarily tests the diner on information (e.g., the codes) known better to the restaurant staff. 15 This testing can detract from the pleasure and purpose of restaurant dining.

Figure 32 depicts the Internet access screen in which 20 diners can type in a specific URL to visit a specific web site using a "soft" keyboard 19.

Figure 33 depicts the split screen functionality of the E-Menu allowing 2 courses, or sub-menus, to be viewed simultaneously as with a traditional hard copy menu.

Figure 34 shows a photo screen of a menu item,  
5 provided according to a preferred embodiment of the E-menu  
of the present invention.

Figure 35 depicts the Filter Display function 39 that  
allows diners to specify categories of menu items that  
10 should be displayed according to various filters.

The Restaurant Automation System increases the efficiency of the dining experience and reduces the amount of time customers unnecessarily occupy a table waiting for  
15 service. For the restaurant, this provides the benefit of turning tables more quickly and thereby increasing revenue. Operational cost is reduced because many front-end processes are automated. Customers are provided greater control over their dining experience because they get what  
20 they want, when they want it. For example, appetizers and the main course can be timed by the customer to ensure that both courses arrive hot when the customer is ready for them. Bill payment can be made at anytime without having

to rely on the arrival of the check. This ultimately eliminates variation in dining times and provides a predictable, controlled dining experience. Customers can tailor their meal to the exact time that is appropriate for 5 their schedule.

Finally, the Restaurant Automation System provides a more comfortable dining experience by eliminating sometimes-intrusive visits by waiters/waitresses for 10 satisfaction inquiries, water refills, plate removal, etc. The Restaurant Automation System puts the customer in complete control of when service personnel arrive and for what purpose.

15 There has thus been shown and described a novel Restaurant Automation System which fulfills all the objects and advantages sought therefore. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to 20 those skilled in the art after considering this specification and the accompanying drawings which disclose the preferred embodiments thereof. All such changes, modifications, variations and other uses and applications

which do not depart from the spirit and scope of the invention are deemed to be covered by the invention, which is to be limited only by the claims which follow.